Demystifying writing papers for biomedical journals

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TEACHING ARTICLE

DEMYSTIFYING WRITING PAPERS FOR BIOMEDICAL JOURNALS

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ABSTRACT

This paper attempts to demystify the publication process in biomedical journals by offering simple step by step recipes on how to write and get published. The author relies on a narrative review and personal experience as a fellow student of publishing to achieve objective. Five stages in the publication process were identified: Planning, Writing, Submission, Managing editorial decisions and Post-acceptance. Planning is probably the most neglected yet the most important stage. The author begins by making sure that all necessary resources are in place, develops careful outline, decides on authorship and selects potential journal for publication. The paper will typically have three sections. The title which contains title of the paper and the list of authors and also key words is the first section. The abstract and the body of the paper are also the second and third sections. The title and abstract are critical and are usually revised many more times than the other parts of the paper. Choosing key words carefully increases the chance of the paper being read and cited. The body of the paper follows what is called the Introduction, Methods, Results and Discussion structure. Submission begins by writing a cover letter that makes the case for the article. Following all the key steps of the submission process avoids early rejection. Respond speedily and graciously and in sufficient detail to reviewers' and editors' comments. Following publication, the author should ensure that the published knowledge is disseminated widely. Overall, writing for biomedical journals is not too mysterious. However, there is no short cut: learning to write successfully takes time and practice.

Key words: *Publication, Scientific writing, Scientific publishing, Reputability.*

INTRODUCTION

Scientific publications make crucial contribution to knowledge transfer, critical debate, innovations and patient care. However, there is a huge waste in both the production and reporting of research. For example, over 50% of studies are never published in full. A similar proportion of studies do not report on planned outcomes (1). Imagine what the world would have missed if Albert Einstein did not publish his work on the theory of relativity or James Watson and Francis Crick did not publish their findings on the deoxyribonucleic acid (DNA) code. There are several barriers to writing scientific papers. The most commonly cited reason is lack of writing skill (2), which will be the focus of this paper. Another important reason may be expectation of immediate impact from one's publications. However, impact of scientific papers is evolutionary than immediate (3). For example, the work leading to the publication of the DNA code by Watson and Crick was in development for nearly 100 years (4). Contributions build over time and seeing immediate impact is the exception than the rule. Contributions may also be of local relevance. For example, a publication resulting from a locally adapted and applied intervention may be only of local relevance although the principles may have broader application. Nevertheless, local relevance is also an important metrics of contribution. A good writing requires time and practice than a novice may realize. A perfect writing is an illusion but the peer review process, as challenging as it sometimes is, makes the writing as perfect as it can be. The peer review process, as imperfect as it is, not only improves the writing but also the writer and is one of the most important aspects of scientific publication.

Writing is an ethical and professional imperative, particularly for those in academic positions. Of course, many do write for more mundane reason, such as to have their names in a journal, expand their curriculum vitae (CV) or because they need it for their promotion. Whatever the incentive, what matters is that scientists write and share their findings or their broader reflections. Writing cannot be left to the few who enjoy writing or feel the responsibility to do so. By providing simple step by step guide on writing scientific papers, with focus on biomedical articles, this paper aims to demystify and encourage scientific writing. No guarantee that any paper would be accepted, but by following the rules and guidance, you increase your chance that your paper will be accepted.

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The author draws on a narrative review of the literature and his own experience as a fellow student, author, reviewer and editor in writing this paper. The paper begins by outlining the basic principles of scientific writing, and proceeds to describe the detailed 'step by step' of writing.

The basic principles of writing: In many ways, writing scientific papers is like journalism "a simple game; it is about finding things out and telling other people about it" (5). As in good journalism, scientific writing relies on getting the "facts straight" and working in a 'limited space'. While journalists focus on what is newsworthy, scientific writers focus on getting the facts straight. The scientific writer develops and describes a robust methodology to allow capturing the story adequately in the report and to ensure that readers can understand how the story was found and, if they followed those methods, can reproduce the results the writers have reported. In this section the main principles of writing are described: who should write a scientific paper, the styles of writing, and the broader study types and journal requirements.

Who should write? If you are asking 'should I be writing a scientific paper', you probably need to write. If you have an important question in your mind and you do not find satisfactory answer in textbooks or journals, that is an invitation for you to do an original research. While waiting to do the original study, it is sometimes equally interesting to write about the question itself, with your hypothesis of what may answer your question. Are you an instructor in a higher teaching institution or a research institution? If the answer is yes, you then need to write. You are someone who will always have appropriate and interesting questions and new observations. Do not ignore those questions or discount your answers. Moreover, you cannot rely on textbooks to provide all the answers. Are you a clinician or a service provider? You need to consider writing. Are you a service user who has ideas about their need or how their need or the need of others may be best met? Then you are a candidate for writing. But, inevitably, most who write are those who are involved in research. And this is almost all members or affiliates of academic and research institutions or higher teaching institutions. If you are in an academic or research institution and your students and the scientific community does not benefit from your publication endeavors, you are probably in the wrong job. However, some people find the task of scientific writing mystifying and intimidating. By the very nature of their profession, most academics and clinicians are perfectionistic. They do not want to embark on something that is not likely to be perfect. This paper is meant to support you to improve your writing. But you need to start. There is no perfect writing--that is a myth. Practice, assisted by the peer-review process will make you "perfect". Peer reviewers almost always want your work to be published. Engaging with the peer review process is unlike any other process. Peer reviewers do not care whether you are a beginning author or an esteemed professor. They provide feedback to improve the form and content of your paper. They will work with you to make your paper as perfect as it could be.

Style of writing: All writers have their own style of writing. However, in general, there are accepted styles in scientific writing (Box 1). Simplicity is top of the list. Facts should be presented in simple and understandable ways. Although some things are too complex to simplify, complexity is 'old fashioned'. "If you try to impress your friends by the obscurity of your style, the use of esoteric neologisms and chronic logorrhea, instead of leading them gently by the hand up the garden of your thoughts, the whole thing will be a flop." (6). Sentences should be short and clearly written in active voice. Facts are written in a modest way, without exaggeration. Scientists must not exaggerate. Repetition is a time-honored teaching method, but is not appropriate in scientific writing. Repetition makes the otherwise interesting research dull and tiring. Be familiar with some of the rules. For example, in most biomedical reports sex, instead of gender, should describe the participant characteristic. Sex refers to the biological and physiological constitution of an individual while gender reflects the person's self-identity and is influenced by social and broader environmental factors (7). Use standard age categories, if categorizing age. This is typically in a five or 10 years interval (0-4| 0-9, etc.). Follow strictly the specifications of the journal style even when they do not seem relevant. Avoid 'inflammatory' comments or comments that affect negatively any human group or race. Almost always, such comments and findings originate from underlying prejudices in the design or interpretation of the findings. Scientific writing should promote all human race.

Box 1. Style considerations for writing for a biomedical journal

Style

- Simplicity
- Brief sentences
- Active voice
- Do not exaggerate
- Avoid repetition
- Use few abbreviations
- Know general rules (e.g., sex vs gender, age categories)
- Follow Journal style

Stages of publication: There are five stages in scientific writing and publication: (1) Planning, (2) writing, (3) submission, (4) editorial decision(s), and (5) post-acceptance. Planning is probably the most important but most neglected aspect of writing. This planning starts from the development of the initial research question, hypothesis and the methodology of the study. The research questions and the methodology to answer these have major bearing on the writing. Therefore, the research plan should also include the writing plan. The writing stage is to do with the actual writing of the paper and most of this paper will be dedicated to this. Care in the submission of the article and handling of reviewers' comments and the decision(s) of the editor are equally important.

Stage 1: Planning:

Recent requirements, for example, registration of clinical trials and systematic reviews, ensure that writing of a paper is consistent with the initial development of the research methodology. Therefore, planning of the paper should start from the initial planning of the research itself. It is now becoming a common practice for research groups to plan for potential papers while developing a research. Reflect on what kind of resources may be required (Box 2). Co-authors are probably the most important resource you need. Almost all biomedical articles, especially if original, involve multiple authors. If you are a beginner, work with people who are experienced in publishing and are interested in supporting your capacity to grow. These people may be in your institution, but you can also go beyond your institution. Adhere to the guidelines of the International Committee of Medical Journal Editors (ICMJE) in choosing co-authors. You may decide to add other co-authors as you progress in writing the paper. If you have core co-authors that are already involved in supporting you, it is worth consulting these co-authors first before inviting additional co-authors. Co-authors must fulfill the co-authorship requirements (8).

A paper outline should also be developed either before or after engagement with co-authors. This outline should present the key background questions and research questions as well as indicative content. The outline helps the author to focus the message of the paper. But the outline should not constrain the author. Attempt to attain an in-depth knowledge of the topic area at this stage by consulting and reading the literature in a systematic way. At this stage, potential target journals would have been identified.

Box 2: Key activities in the planning stage

Planning stage
- Find a question of interest
- Develop an outline
- Choose a target journal
  - Relevance to the field
  - Acceptability to the main audience
  - Reputability
  - You like journal?
  - Speed of publication
  - Handling of publication process and ease of process
  - Fee involved?
- Read the requirements of the journal
- Beware of 'predatory' journals
- Consult with potential co-author (s)
- Select one skilled mentor, or someone who is interested in you and not themselves, to be a senior author

Choosing a target journal as early as possible will help structure the writing. It is not always easy to select a target journal though. Several factors will help choose journal. It is balancing between these factors that will ultimately lead you to a journal of your choice. (i) Is the journal relevant to the field? This is obvious but not always easy. It is important to be familiar with as many journals as you can with relevance to your field. You can find these through journal indexing systems. Some publishers, e.g., Elsevier (http://journalfinder.elsevier.com/), have search technologies that assist authors in choosing journals. But such technologies are likely to focus on journals that are within their systems. Sometimes, given their nature, such automated systems do choose odd journals. It is therefore impossible to rely on these. (ii) Who is likely to read your work? (iii) Would your publication be accessible? (iv) What is the reputability of the journal? Impact factor is the main measure of reputability but is not the only measure. Some journals have good reputability within a field or within a region

despite relatively low impact factor. Once you have chosen a target journal, read recent articles published in the target journal to familiarize yourself with the journal style. It is very important to make sure your writing is compatible with the journal style.

Do the basics. Be familiar with the journal requirements. It is somewhat tedious but almost no two journals have identical requirements. Also make sure that the language meets basic standards. It may be necessary to get a native English speaker to read your article (if writing in English, for example). Short papers are more readable. Don't make your paper long when you can do with short. The abstract is the most important part of the paper and spend as much time as you need on this. Beware of junk or predatory journals (9). There are over 11,000 predatory journals that write directly to authors and solicit papers. Often these are journals that are not in your field, are just coming to the market or are based on a business model that require you to pay before publication. Unfortunately, three quarters of the publications in these journals have been from Africa and Asia. Unless you have knowledge about the reputability of the journal, check thoroughly the reputability of publishers and the journals. You can also check with colleagues who have experience publishing.

Choosing journal article type: There are several types of articles. The common types are: original article, systematic reviews, commentary, teaching article, case report, case series, debate, editorial, letters (correspondences) and personal views. Original articles are the most prestigious article types and wanted by journals. These articles rely on presentation of new data. As the name implies, systematic reviews are based on systematic approaches for collating literature available. The term meta-analysis is used if numerical synthesis of the reviewed literature is also presented. Commentaries are essentially personal reflections on a topic of major importance. These should be topical and are likely to spark debate on the subject. Teaching articles provide specific educational content on a topic of importance. These articles may take the form of a review or didactic synthesis or the latest knowledge on the topic. Case reports are brief descriptions of a case, often story of a patient, presented as an educational illustration of a condition or an intervention. A case series compiles several case reports on a single case or issue. Editorials represent the view of the journal publishing them and describe a cutting-edge knowledge or practice. This may be written by editors of a journal or invited authors. Letters or correspondences are brief notes written in a letter style and present questions or expand on a topic that has been just published. Some journals encourage online responses to published articles and support debate in that way. But these online responses are not identical to letters or correspondences and may have less importance. Personal views are more extended versions of commentaries. Not all journals have all these options. Therefore, check whether the journal you have selected provides for the article type you plan to write.

Stage 2: Writing:

Most of the author's time is spent writing. There are three parts (Box 3): Title (Title page), Abstract and Body of the paper (TAB).

Box 3 Typical Structure of a Journal Article

Title (to include author list and key words)
Abstract
Body of paper *(*Introduction, Methods, Results and Discussion) structure
- Introduction
- Method
- Results (and)*
- Discussion

Reference

*Note that some journals may require results and discussions to be put together. Although tables and figures are presented within the text in the published paper, they are usually submitted as a separate file.

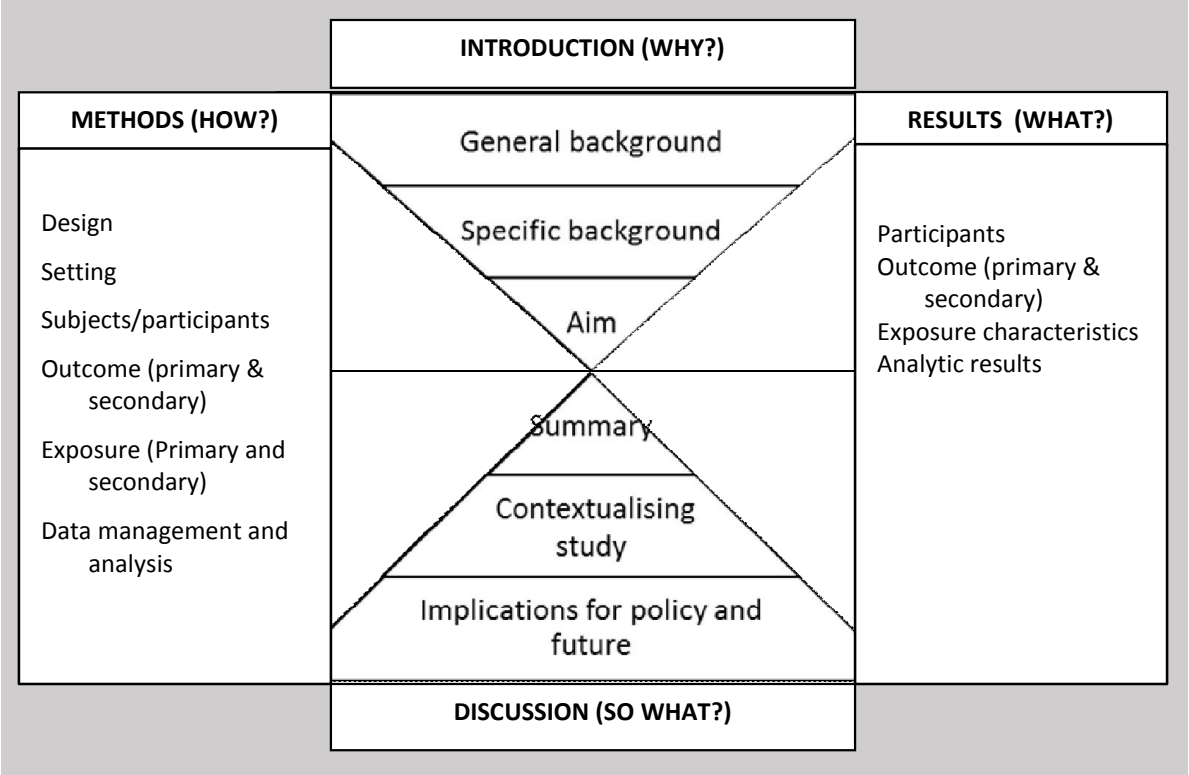
Title: The title page typically includes the actual title of the paper, the key words and the authorship list. The actual title must be catchy and brief while sufficiently descriptive of the content of the paper itself. Although it may be a common practice to write a title first, it is probably better to wait until all parts of the manuscript have been described. Journals allow a pre-specified number of Key words to help readers access the published paper and should be selected carefully. The Medical Subject Headings (MESH) terms are important sources of key words. The title is included for indexing and it is not efficient use of the Key word opportunity to include words of the title in the key words. Authorship is the most difficult and contentious issue at this stage. The ICMJE requires that co-authors should (1) have made substantial contribution to the intellectual content of the paper; AND (2) Draft or comment on the paper; AND (3) approve submission; AND (4) be willing to be accountable for the content of the paper (8). While this should not be a controversial guidance, authors are often confronted by concern that some colleagues and mentors may have undue expectations of authorship. Unmet expectations have the potential to affect 'team harmony' and 'personal relationships' (10). It is important that all potential authors are familiar with this ICMJE guidance and avoid participation in a 'scientific fraud'.

Abstract: The title and the abstract carry the key messages of the content of the paper and require due attention. Depending on the guidance of the journal, abstract may be structured or unstructured. However, even in unstructured format, the abstract follows the structure of the main paper. The abstract should highlight clearly why the study was done, state the study design and key methods; describe the key results and conclusions to be drawn from the results. Some journals also require inclusion of pertinent limitations in the abstract. As in the title, the abstract may be written once the main parts of the paper are put together. However, some authors prefer to begin with the abstract once they have run statistical analysis and have done the literature review. This gives them opportunity to review the abstract throughout the writing process. Arguably, as the most important part of the whole paper, the abstract will benefit from such continuous revision. At least, this is the experience of this author.

The main body of the paper: The main body of the paper follows the IMRaD (Introduction, Materials and Methods, Results and Discussions) structure (11). The introduction tells readers WHY a study was done, while the methods section describes HOW the study was done. The results report on WHAT the study found and discussions reflect on what the results mean. The introduction is a mirror image of the discussion and the method section is a mirror image of the results (Fig. 1). The introduction begins by providing a broad background and ends with the narrow description of the aim of the study. The discussion begins by providing a brief summary of the findings and provides increasing broader interpretation of the findings by contextualizing the study and offering implications for policy and future work. The results reflect what was carried out through the experiments and provides details of the characteristics of the participants and the exposures and outcomes that were found.

***Introduction*:** The length and details of what is to be included in an introduction vary by journal. However, introductions should focus on the research question that the study attempted to answer. What is known and what remains to be known (12) is highlighted briefly. As few as three citations, particularly from different sources, may suffice to justify the relevance of the study questions and the conduct of the study (11). However, some journals require a more extensive review of what has been known, and the gaps in what is known as part of the introduction of the paper. At any rate, the introduction should be short, and any citation included should be pertinent to the research question to be addressed. It is a good discipline to limit to a single primary research question with about three secondary questions to address. The same goes for hypotheses.

Figure 1. A mirror image summary template of the content of the body of a typical paper



Method: The method should describe how the study was done in sufficient detail (12). The details to be included vary by study design. For example, a laboratory based study should provide extensive biological details on the biological materials and resources used while a clinical trial should detail the trial procedures explicitly. However, typical headings of any methodology include: study design, setting, participant selection procedures, outcomes, exposures, the data management and analysis, which should include sample size calculation, hypothesis testing and other specific statistical approaches used. The statistical analysis section should provide sufficient detail on the analysis used. Usually, ethical considerations, including ethics approval procedures are included in this section. Once the methodology section is written, it has to convince the author that an interested reader would be able to reproduce the study based on what is described in the methodology (13).

Results: This section details the findings of the study using descriptions and illustrations through figures, tables, and boxes. The results should provide answer to the research questions. If the journal allows, it is easier to write the result using sub-headings. Start by describing the characteristics of participants. The primary and secondary outcomes and their association to the exposure or intervention variables then follow. In terms of style, one paragraph should be dedicated for each topic or main outcome, progressing from "most important to least important" (11) within the framework of the primacy of primary outcome. While only relevant data has to be presented, one of the main problems here is also selective reporting (1). All key results should be reported whether they confirm or refute the hypothesis of interest. Figures and tables should be kept to the minimum but are important tools for explaining the findings. Journals have guidelines on the acceptable number of figures and tables but should generally be kept to the minimum possible—usually to a maximum of three figures and five tables. All such illustrations should be self-explanatory, and the text description should not repeat what is in the figures and tables except for summary and clarity. All illustrations should be cited in the text of the results.

Discussion: Should not be long and the general rule of thumb is that the discussion should be about a third of the total length of the paper (including the introduction, methods, results and discussion) (11). Within this framework, the accepted guidance is to limit the discussion to "seven to eight paragraphs of three to four sentences each" (14). Begin by providing the highest summary of the major findings (Fig.1). Situate the findings in context by relating the findings with what is known and not known in the field of study. Reflect on the policy, research and clinical implications of the findings. The

limitations or weaknesses of the study should also be described here. Such limitations should normally be anticipated, and all attempts made to address during the implementation of the study. The limitations should be unavoidable limitations and must not be critical short comings that affect the inference that is to be made from the study. Nevertheless, such critical limitations do arise. It is important to be transparent and report so that readers can make a decision for themselves about the relevance of the study. Offer suggestions for further research and conclude with a brief conclusion.

Additional sections:

Reference: should follow the guideline of the journal. Use reference software. This is not only to make the reference work easy but to improve on the error prone task of writing the bibliography. If the reference style of the journal to be submitted to is not available readily in the software, it is easy to adapt and develop the desired style within the reference software. There is a tendency to give priority to reference articles from journals of high impact factor. But appropriate articles may in fact be found in journals of lower impact factor. The driver of the decision of whether to cite or not should be the appropriateness and the quality of the work rather than the source journal. Nevertheless, sources from predatory journals are suspect because of the questions about the editorial standards of such journals.

Acknowledgements: Source of funding should be indicated. It is also very important to state any potential conflict of interest whether the journal requires it or not. Some who have contributed in different ways without providing substantial intellectual input to the work to deserve co-authorship would be acknowledged. Patients or participants would also be acknowledged.

Stage 3: Submission:

You have to get this right. You do not want to stumble at the first hurdle. You have a chance of getting published if paper is sent to reviewers. Format the cover letter politely whatever journal the paper is being submitted. You submit to a journal because you want the paper to be published. You are not doing the journal a favour. Whenever you can find out, address the cover letter to the Editor or Editor-in-Chief. The recommendation on the content of the letter varies but would typically include information on the paper and why the paper is being published in that particular journal. This is your last opportunity to make sure that your paper complies with the requirements of the journal: How does the journal like the title? Should the authors be listed in a separate document to maintain anonymity? How should the abstract and other parts of the paper be structured? What is the recommendation for intext citation and the bibliography?

Stage 4: Dealing with editorial decision(s):

Editorial decisions include requests for initial correction, and request for changes based on the reviewers' and editor's comments. Reviewers' and editors' comments and decisions should normally be greeted with gratitude and appreciation. Timely and respectful response (Box 4) from the author(s) should come naturally. But many authors focus on their need rather than the service they have received. The response of authors in some cases is understandable because comments from the rare reviewer can be condescending and less than helpful, but in this author's experience, such reviewers are the exception than the rule. Even when a review is apparently unkind, the goal is the same: to improve the quality of the paper to get it to publication. It is in no way helpful for the author to respond in kind. Lysle and Hoerr from over 50 years ago make an important observation about the 'malady' of ungratefulness from authors: "…The therapist (the editor) must take the time to scrutinize the manuscript for every type of mistake-from the obvious to the hidden. If the author is resentful of criticism, he cannot be helped; he is the patient who refuses to undergo an operation for acute appendicitis. It is a natural reaction, though, since all of us know English and are authorities on the written or spoken Word"(15). The tone of the response does not always translate equivalently from one language to another. What appears polite and appropriate in one language may come across as inappropriate and even rude in another language. Remember, rejection is also part of the experience of many authors. The rate of rejection is up to 95% in some journals. Good journals give you feedback. Revise using the comments and submit to another journal as soon as possible.

Box 4. Suggestions for responding to reviewers' and editor's comments

- Be respectful and show appreciation. Your response or correspondences should not appear to express a sense of entitlement.
- Be prompt in response-if unlikely to respond within the time given by the journal, let the journal know about the delay specifying how long it would take to submit response.
- Provide a cover letter as part of your response.
  - In the cover letter, appreciate the effort of reviewers and indicate that you have provided a point by point response.
- Provide a point by point response to queries. Be precise in the response.
  - You do not need to agree with all the comments but avoid combativeness or defensiveness.

Stage 5: Post-acceptance:

This is another neglected area. There is a huge number of journals and publications in the world. Having your publication in a journal does not mean that people will know about it or use it. In fact, it is likely that only very few people would know about your publication. Make sure that all that can benefit from reading your publication have access to your work and know about it. Think about what you might do to disseminate the knowledge. Depending on the appropriate audience, presentations, policy briefs, media briefs and online postings could be used. If the journal allows, you can post your publication online on your institution's website or other places, such as Research Gate.

Table 2 The Equator Network's Reporting Guidelines for Main Study Types

Name of Reporting Guideline	Function	Remark (Reference)
AGREE	Clinical practice guideline	
ARRIVE	Animal preclinical studies	
CARE	Case reports	
CENT (CONSORT extension for reporting N-of-1 trials)	N-of-1 Clinical Trials	Expands the CONSORT recommendations to support preparation and reporting of N-of-1 trials, including multiple, crossover N-of-1 trials (16).
CHEERS		
CONSORT (Consolidated Standards of Reporting Trials)	Clinical trials	
CReDECI	Complex interventions	16 item criteria list corresponding to the main steps in complex interventions (17)
GPP3	Good publication practice	
GRADE		
PRISMA	Systematic reviews	
RECORD (The Reporting of studies Conducted using Observational Routinely-Collected Health Data)	Observational studies from routine clinical data	An extension of STROBE, offers recommendations and guidelines for observations studies from routine care records(18).
REMARK	Tumor marker studies	
SPIRIT ()	Study protocol	
SQUIRE	Quality improvement studies	
SRQR	Qualitative study	
STARD	Diagnostic/prognostic studies	
STROBE (Reporting of Observational Studies in Epidemiology)	Observational studies	
TIDieR	Interventions	

Conclusion: There is no intention to suggest in this paper that writing is an easy task. But, there are many resources, for example, the Equator guidelines (20) (Table 2), that assist authors in writing. Writing is also about practice and learning from feedback, good and bad. Remember that you make an important contribution to the world of biomedical science when you write. The reason you do not write should not be because you do not think your work does not contribute or because you do not think you have the skills.

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